"THERMOSTATIC MIXING VALVE"

The present invention relates to taps for mixing hot and cold water in sanitary facilities (wash-basins, showers, bathtubs, etc.), and in particular to a cartridge mixing valve provided with a thermostatic device suitable to maintain a constant water temperature.

It is known that conventional single-control mixing taps include a tap body with a cartridge mixing valve (hereinafter simply valve) removably inserted therein and a control lever for controlling a valve group, within the cartridge, made up of a pair of ceramic disks which adjust the flow of hot and cold water. This adjustment of the water, both in flow rate and in temperature, is carried out through the translation and rotation, respectively, of a mobile disk over an underlying fixed disk. In this way, the extent of aperture of the ports formed in said disks for the passage of hot and cold water is changed, and so is the ratio between hot water and cold water when they are mixed prior to the conveying to the tap mouth.

In order to maintain a constant temperature of the delivered water, both between two tap openings and during a same opening, it is possible to incorporate a thermostatic device in a conventional tap. Such a device acts downstream from the valve group by controlling the inflow of hot and cold water into the mixing chamber through respective ports.

As it will be better explained further on, this control is carried out automatically by a thermosensitive bulb which causes the shifting of a slider suitable to change the aperture of said ports in the mixing chamber. However, although known from some time, conventional thermostatic mixing valves still have some drawbacks of various nature.

A first drawback is the asymmetric thermal expansion that occurs when only hot water is delivered. In fact the metallic members of the thermostatic device are passed through by hot water coming from one side only, whereby they expand more on one side and tend to warp. As a result they may not work properly, for example the slider may get stuck and thus affect the operation of the device.

A second kind of drawback comes from the calcareous encrustations, especially on the hot water side, which may jeopardize the correct operation of the device. This problem stems from the fact that the slider travel is of a few tenths of millimeter (usually max. 0,6 mm), therefore even small-size impurities may prove detrimental.

Still another kind of drawback is the use of a single control for temperature

substantially cam-shaped along about 180° and does not reach the top face of the disk.

In other words, port 5c is not a real port but a chamber formed in the bottom face, and it extends on the disk side opposite with respect to the side where port 5f is formed. The cam-shaped contour allows to perform the progressive closing of port 4c to adjust the flow rate of hot water, which does not pass through slider 8 but flows directly into base 2 mixing with the cold water coming from above.

It should be noted that the hot water chamber may also be formed partially or completely in the top face of the fixed disk 4, proportionally reducing the height of the mobile disk 5.

It is therefore possible to close the cold water completely, with the slider 8 abutting against member 13, and to have the hot water pass only through the two ceramic disks 4, 5 and base 2 without passing through slider 8.

It is also clear that the temperature (6, 14-18) and flow rate (13, 20) controls are absolutely independent, and the latter act directly on the mobile disk 5 without dragging other elements.

Moreover, the valve is shorter and is made up of only 22 pieces, of which three pieces are simple O-rings (7, 11, 12), two pieces are other gaskets (1, 3), three pieces are retaining rings (14, 21, 22) and other two pieces are simple springs (6, 16), while the thermostatic member 9 is commercially available. Therefore the pieces which have to be custom-made either in metal, plastic or ceramic are 11 only, with a consequent significant advantage in terms of manufacturing cost.

In order to reduce further the number of pieces it is even possible to form insert 10 integral with member 9, or the fixed disk 4 integral with base 2 dispensing with gasket 3. In this latter case, also the risks of leaks due to wear and/or wrong mounting of gasket 3 are prevented, however this solution implies manufacturing a base 2 of a ceramic material same as disk 5, so as to carry out the mobile sealing between members of the same material.

It is clear that the above-described and illustrated embodiment of the valve according to the invention is just an example susceptible of various modifications. For example, the exact shape and number of the members enclosed within housing 19 may be changed, in particular disks 4, 5 as well as base 2 as previously mentioned. Furthermore, all the members may be replaced by other mechanically equivalent members, such as recesses 4a and 5a which may be other types of rotational couplings.

Also the top face of the upper disk 5 is sealed, thanks to an O-ring 12, against said member 13, so that the water is restrained below member 13. In this way the water pressure can not interfere with the operation of the temperature and flow rate controls located in the top portion of the valve.

The operation of the thermostatic device of the present valve is similar to that of conventional thermostatic valves and is based on the thermostatic member 9 which, according to the mixed water temperature detected by the bottom bulb, causes the shifting of slider 8 within the transmission member 13 and the upper disk 5. Due to the push of the upper rod against a cap 15 secured, by means of a retaining ring 14, inside an adjusting bar 17 and pushed downwards by a spring 16, the thermostatic member 9 shifts slider 8 so as to change the extent of aperture of the inflow ports of the hot and cold water. These ports are formed, respectively, between the lower edge of slider 8 and the upper edge of base 2, within the upper disk 5, and between the upper edge of slider 8 and the transmission member 13.

The position of the adjusting bar 17, and therefore the compression of the lower spring 6, is set by rotating, through a non-illustrated knob, a temperature control member 18 which is screwed on the top portion of bar 17.

The control member 18 projects from a housing body 19, which encloses the above-described elements and is coupled to base 2, and is axially locked on said body 19 by a retaining ring 22. Similarly, a flow rate control member 20 is inserted on the outside of body 19 and axially locked thereon by a retaining ring 21.

Member 20 externally engages the transmission member 13 by passing through suitable slots formed in body 19; on the latter there is also formed a grooved surface, above a similar grooved surface of member 20, to secure a fixed reference member for the setting of the temperature through member 18.

Referring now also to figs.3 and 4, there is seen that the fixed lower disk 4 is conventionally provided with three water passage ports 4c, 4f and 4m for the hot, cold and mixed water, respectively, as well as with a plurality of lateral recesses 4a (four in the illustrated example) to be blocked in base 2.

Also the mobile upper disk 5 is provided with similar lateral recesses 5a (three in the illustrated example) to be driven into rotation by member 13 through corresponding stems, as well as with ports 5f, 5m for the passage of cold and mixed water respectively.

The novel aspect of disk 5 according to the present invention is given by the fact that in practice port 5m does not act as passage for the mixed water but as a seat for the sliding of slider 8, and by the fact that port 5c for the hot water extends